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EXAMINER	
PERKINS, PAMELA E	

ART UNIT	PAPER NUMBER
2822	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/667,277	KLEPPER ET AL.
	Examiner	Art Unit
	Pamela E. Perkins	2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 April 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-48* is/are pending in the application.

4a) Of the above claim(s) *31 and 46-48* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-30 and 32-45* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 September 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

This office action is in response to the filing of the election on 15 April 2005. Claims 1-48 are pending.

Election/Restrictions

Applicant's election with traverse of group I, claims 1-3,6-8, 10-27-30, 32, 35, 36, 38 and 40-45 in the reply filed on 15 April 2005 is acknowledged. The traversal is on the ground(s) that group I, II, III, IV, VI, VII and VIII have the same classification. This is persuasive.

Pursuant to the procedures set forth in the Official Gazette notice dated March 26, 1996 (1184 O.G. 86), claims 4, 5, 9, 28, 29, 33 and 34 are directed to the process of making the product, previously withdrawn from consideration as a result of a restriction requirement are now subject to being rejoined. Process claims 4, 5, 9, 28, 29, 33 and 34 are hereby rejoined and fully examined for patentability under 37 CFR 1.104. Claims 31 and 46-48 are not directed to the process of making the product, will not be rejoined.

The traversal is also on the grounds that there is not support in the distinction between group I and group V. This is not found persuasive because the "assumption" that a close relationship exists between the two inventions is apparent, however this in itself does not overcome the restriction requirement. According to M.P.E.P. § 803, the proper criteria between for a restriction is (1) the inventions must be independent and separate and (2) there must be serious burden on the Examiner if the restriction is not required. The product and the process of manufacturing a semiconductor device are

considered to be separate and independent by the Office. They are classified in two different art classifications and assigned two different sets of Art Units. It would be a serious burden on the Examiner to examine two such distinct inventions despite the fact that they are so closely related.

The requirement is still deemed proper and is therefore made FINAL.

Information Disclosure Statement

The information disclosure statement filed 19 September 2003 fails to comply with 37 CFR 1.98(a)(1), which requires the following: (1) a list of all patents, publications, applications, or other information submitted for consideration by the Office; (2) U.S. patents and U.S. patent application publications listed in a section separately from citations of other documents; (3) the application number of the application in which the information disclosure statement is being submitted on each page of the list; (4) a column that provides a blank space next to each document to be considered, for the examiner's initials; and (5) a heading that clearly indicates that the list is an information disclosure statement. The information disclosure statement has been placed in the application file, but the information referred to therein has not been considered.

Claim Objections

Claim 30 is objected to because of the following informalities: line 1 of claim 30 states "...wherein a gas y be deliberately introduced...". Appropriate correction is required.

Claim 45 objected to because of the following informalities: line 1 of claim 40 states "...method of claiqm 1 wherein....". Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 14, 28, 35, 38, 39 and 40 are rejected under 35 U.S.C. 102(b) as being anticipated by Beck et al. (3,960,605).

Referring to claims 1, Beck et al. disclose a method of implanting boron ions into semiconductor materials at specified energies including providing a source of boron ions or boron ion plasma where the ions or plasma originate from solid boron material, and wherein the plasma is defined as a state of matter in consisting of ionized cores and free electrons with approximate overall charge neutrality in space, and streaming the ions or plasma against a target semiconductor material and thereby implanting them because of energetics suitable for penetration into the material (col. 2, lines 7-23).

Referring to claim 14, Beck et al. disclose the target is a silicon wafer (col. 6, lines 23-30).

Referring to claim 28, Beck et al. disclose a method of ion implantation of boron, wherein every process including steps of providing for generation of plasma and streaming of boron ions to the target are conducted with all components in a vacuum (col. 2, lines 11-20).

Referring to claim 35, Beck et al. disclose providing the necessary cooling or attenuating the implantation rate, as desired, to achieve the desired low temperature during implantation (col. 4, lines 21-40).

Referring to claim 38, Beck et al. disclose wherein the beam or plasma may be deflected, steered, or confined by magnets or magnetic Gelds of various geometries for the purpose of containment of plasma, directing the beam to the particular target, or separation of ions from macroparticles (col. 5, lines 11-21).

Referring to claim 39, Beck et al. discloses a method of providing boron ions for implantation into semiconductors by beam or plasma immersion and which requires no toxic carcinogenic, flammable, pyrophoric or explosive feed material of any kind, in particular, gaseous material (col. 2, lines 1-6).

Referring to claim 40, Beck et al. disclose the beam has one or more ion species added from one or more separate ion sources for purposes of growing compounds or growing semiconductor materials with the p-dopant grown in (col. 6, lines 23-30).

Claims 1-5, 8-12, 14-16, 19, 21, 24, 28-30, 33, 36-42 and 45 are rejected under 35 U.S.C. 102(b) as being anticipated by Booske et al. (5,672,541).

Referring to claim 1, Booske et al. disclose a method of implanting boron ions into semiconductor materials at specified energies including providing a source of boron ions or boron ion plasma where the ions or plasma originate from solid boron material, and wherein the plasma is defined as a state of matter in consisting of ionized cores and free electrons with approximate overall charge neutrality in space, and streaming the ions or plasma against a target semiconductor material and thereby implanting them because of energetics suitable for penetration into the material (abstract).

Referring to claim 2, Booske et al. disclose wherein the boron ions are produced and provided by a plasma plume generated from an electrode of solid and pure boron (abstract).

Referring to claim 3, Booske et al. disclose wherein the boron ions or plasma plume are produced and provided from a solid electrode of boron compound or boron composite material, such as boron carbide (col. 4, lines 28-35).

Referring to claim 5, Booske et al. disclose a method of ion implantation doping wherein a plasma is 100% ionized and consists only or boron ions and ions of other atomic species that have organized in a boron composite or boron compound electrode (col. 4, lines 54-60).

Referring to claim 8, Booske et al. disclose wherein an electrode arc system is operated in either a continuous or pulsed mode (col. 6, lines 53-65).

Referring to claim 9, Booske et al. disclose a method of streaming boron ions onto a target in which the total ion arrival rate or ion implantation rate, expressed as a

total electric current impinging on the target material, is at least 0.3 amps or greater (col. 12, lines 3-5).

Referring to claim 10, Booske et al. disclose the technique of streaming the ions onto the target uses the principle of plasma source ion implantation which means that the target is biased relative to the plasma potential so that boron ions are extracted directly to the target from the plasma across the plasma sheath (col. 11, lines 27-33).

Referring to claim 11, Booske et al. disclose the boron ions are directed to the target by the technique of beam extraction from the plasma and then transport of said beam to the target over distances much larger than the plasma sheath (col. 11, lines 51-60).

Referring to claim 12, Booske et al. disclose a way to eliminate macroparticles from the ion stream so as to limit or eliminate impingement or macroparticles onto the target (col. 7, lines 43-53).

Referring to claim 14, Booske et al. disclose the target is a silicon wafer (col. 3, lines 58-60; col. 4, lines 46-48).

Referring to claim 15, Booske et al. disclose the target is diamond or contains diamond semiconductor material (col. 3, lines 58-60).

Referring to claim 16, Booske et al. disclose the target is silicon carbide (col. 3, lines 50-54).

Referring to claim 19, Booske et al. disclose wherein the boron ion doses and energies, together with any subsequent treatments, are designed to produce the result

known as "p-doping" of the silicon or other semiconductor material (col. 4, lines 28 and 29).

Referring to claim 21, Booske et al. disclose claim 2 wherein the solid electrode from which the plasma originates has been synthesized by use of rf induction heating (col. 10, lines 48-59).

Referring to claim 24, Booske et al. disclose wherein the solid electrode from which the plasma originates has been synthesized by chemical precipitation (col. 4,lines 54-60).

Referring to claim 28, Booske et al. disclose a method of ion implantation of boron, wherein every process including steps of providing for generation of plasma and streaming of boron ions to the target are conducted with all components in a vacuum (col. 4, lines 44-48).

Referring to claim 29, Booske et al. disclose wherein the vacuum precludes deliberate introduction any non-solid matter, in particular gaseous matter, other than the plasma and ions originating in the solid electrode (col. 6, lines 10-22).

Referring to claim 30, Booske et al. disclose wherein a gas may be deliberately introduced into the stream of ions or plasma, possibly in the vicinity of the target, to provide for collisions with boron ions to help randomize the incident ion directions, produce a compound by reaction in the system, to reduce target sputtering by backscattering sputtered atoms, to produce cleaning of the target surface or the like (col. 7, lines 2-10).

Referring to claim 33, Booske et al. disclose a method of ion implantation of boron into semiconductor silicon in which the target is amorphized at boron doses normally used for p-doping due to the extraordinary damage rate associated with the high temperature rate (col. 1, line 59 thru col. 2, line 15).

Referring to claim 36, Booske et al. disclose wherein the ions are first generated and then transported to the target by beam techniques in which the boron atoms are separated from the electrons of the plasma by electrostatic acceleration (col. 14, lines 57-60).

Referring to claim 37, Booske et al. disclose a method of ion implantation of boron into semiconductor material wherein there is neither a magnet provided nor magnetic separation of ions into atomic or isotopic species by mass analysis, nor are there any other ions or atoms co-implanted or impinging on the target surface as part of the process (col. 7, lines 41-43).

Referring to claim 38, Booske et al. disclose wherein the beam or plasma may be deflected, steered, or confined by magnets or magnetic Gelds of various geometries for the purpose of containment of plasma, directing the beam to the particular target, or separation of ions from macroparticles (col. 7, lines 43-53).

Referring to claim 39, Booske et al. disclose a method of providing boron ions for implantation into semiconductors by beam or plasma immersion and which requires no toxic carcinogenic, flammable, pyrophoric or explosive feed material of any kind, in particular, gaseous material (col. 4, lines 14-27).

Referring to claim 40, Booske et al. disclose wherein the beam has one or more ion species added from one or more separate ion sources for purposes of growing compounds or growing semiconductor materials with the p-dopant grown in (col. 7, lines 2-10).

Referring to claim 41, Booske et al. disclose wherein the beam is electrostatically deflected for separation of the beam from macroparticles and including the further step of mechanically trapping the macroparticles (col. 4, lines 54-65; col. 7, lines 41-53).

Referring to claim 42, Booske et al. disclose wherein the beam, after separation from the macroparticles, has its energy changed before impinging on the target surface (col. 11, lines 61-67).

Referring to claim 43, Booske et al. disclose wherein the plasma is reconstituted after a slowing down or lowering of energy of the beam (col. 11, lines 61-67.

Referring to claim 44, Booske et al. disclose wherein the reconstituted plasma is applied to the surface by the plasma immersion technique (col. 2, lines 40-43).

Referring to claim 45, Booske et al. disclose wherein the energy of deposition of the boron is so low as to result in a coating instead of an implantation p-doping of the target (col. 2, lines 60-62).

Claims 1, 2, 4, 14, 19, 22, 34 and 37 are rejected under 35 U.S.C. 102(b) as being anticipated by Obara et al. (6,562,705).

Referring to claim 1, Obara et al. disclose a method of implanting boron ions into semiconductor materials at specified energies including providing a source of boron

ions or boron ion plasma where said ions or plasma originate from solid boron material, and wherein said plasma is defined as a state of matter in consisting of ionized cores and free electrons with approximate overall charge neutrality in space, and streaming said ions or plasma against a target semiconductor material and thereby implanting them because of energetics suitable for penetration into the material (abstract).

Referring to claim 2,Obara et al. disclose wherein the boron ions are produced and provided by a plasma plume generated from an electrode of solid and pure boron (col. 4, lines 41-53).

Referring to claim 4, Obara et al. disclose a method of ion implantation doping wherein plasma is involved in virtually 100% ionized pure boron plasma, meaning no other ionized atom species and no other non-ionized gas atoms in the plasma source (col. 4, lines 40-53).

Referring to claim 14, Obara et al. disclose the target is a silicon wafer (col. 3, line 20).

Referring to claim 22, Obara et al. disclose the solid electrode from which the plasma originates has been synthesized by use of direct current heating (col. 4, lines 45-53).

Referring to claim 34, Obara et al. disclose a method of ion implantation of semiconductor silicon with boron wherein the target may be deliberately heated to a desired temperature by the implantation process due to the extraordinary rate of heat deposition resulting from the high rate of ion deposition (col. 4, lines 15-30).

Referring to claim 37, Obara et al. disclose a method of ion implantation of boron into semiconductor material wherein there is neither a magnet provided nor magnetic separation of ions into atomic or isotopic species by mass analysis, nor are there any other ions or atoms co-implanted or impinging on the target surface as part of the process (Fig. 4; abstract).

Claim 5 is rejected under 35 U.S.C. 102(e) as being anticipated by Goldberg (6,905,947).

Referring to claim 5, Goldberg discloses a method of ion implantation doping wherein a plasma is 100% ionized and consists only or boron ions and ions of other atomic species that have organized in a boron composite or boron compound electrode (col. 2, lines 24-27).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 6, 7, 13, 18, 20, 25-27 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Booske et al. in view of Foad (5,977,552).

Booske et al. disclose the subject matte claimed above except the plasma plume is generated by a two-electrode vacuum arc system, known as a cathodic arc system

and the firing and timing of the arc is stimulated by a triggering technique such as laser firing, an external electron gun or inducing a spark.

Foad discloses a method of ion implantation doping wherein a plasma is 100% ionized and consists only or boron ions and ions of other atomic species that have organized in a boron composite or boron compound electrode (col. 2, lines 40-51).

Since Booske et al. and Foad are both from the same field of endeavor, a method of ion implantation, the purpose disclosed by Foad would have been recognized in the pertinent art of Booske et al. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Booske et al. by the plasma plume is generated by a two-electrode vacuum arc system and the firing and timing of the arc is stimulated by an external electron gun as taught by Foad to provide high wafer processing speeds (col. 1, lines 53-57).

Referring to claims 6 and 7, Foad discloses wherein the plasma plume is generated by a two-electrode vacuum arc system by application of a suitable voltage between the electrodes with possible application of arc triggering techniques (col. 6, lines 35-58).

Referring to claim 18, Foad discloses the boron ion energies up to 200 keV (electron volts) (col. 5, lines 45-49). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Booske et al. by boron ion energies up to 200 keV as taught by Foad to provide high wafer processing speeds (col. 1, lines 53-57).

Referring to claim 25, Foad discloses wherein the solid electrode from which the plasma originates has been synthesized by use of pressure assisted sintering with heat (col. 8, line 61 thru col. 9, line 3). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Booske et al. by the plasma originates has been synthesized by use of pressure assisted sintering with heat as taught by Foad to provide high wafer processing speeds (col. 1, lines 53-57).

Referring to claims 26 and 27, Foad discloses wherein there is an arc in the vacuum space between the electrodes, and the firing and timing of the arc is stimulated by a triggering technique such as an external electron gun (col. 5, lines 61-64).

Referring to claim 13, Booske et al. do not disclose specific diameters of targets. It would have been obvious to one having ordinary skill in the art at the time invention was made to treat surface for targets of various sizes and up to 30 cm in diameter or greater disclosed in the claimed invention, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233 (CCPA 1955).

Referring to claim 20, Booske et al. disclose the claimed invention, including forming shallow junctions, except for the specified boron ion energy is selected in the range of 100 eV to 2 keV. It would have been obvious to one having ordinary skill in the art at the time invention was made to have the specified boron ion energy is selected in the range of 100 eV to 2 keV, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233 (CCPA 1955).

Referring to claim 32, Booske et al. disclose the claimed invention except for a plasma density up to $10^{12}/cm^3$ of boron ions. It would have been obvious to one having ordinary skill in the art at the time invention was made to have a plasma density up to $10^{12}/cm^3$ of boron ions, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233 (CCPA 1955).

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Booske et al. in view of Protic et al. (4,415,916).

Booske et al. disclose the subject matter claimed above except the target is germanium or contains germanium semiconductor material.

Protic et al. disclose discloses a method of ion implantation doping wherein a plasma is 100% ionized and consists only or boron ions and ions of other atomic species that have organized in a boron composite or boron compound electrode (col. 1, lines 12-16).

Referring to claim 17, Protic disclose the target as germanium (col. 1, lines 12-16).

Since Booske et al. and Protic et al. are both from the same field of endeavor, a method of ion implantation, the purpose disclosed by Protic et al. would have been recognized in the pertinent art of Booske et al. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Booske et

al. by the target as germanium as taught by Protic et al. to increase stability at high voltage (col. 1, line 51-55).

Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Booske et al. in view of Goldberg.

Booske et al. disclose the subject matter claimed above except the plasma originating has been synthesized by use of a microwave heating at a broad range of frequencies.

Goldberg discloses a method of ion implantation doping wherein a plasma is 100% ionized and consists only or boron ions and ions of other atomic species that have organized in a boron composite or boron compound electrode (col. 2, lines 24-27).

Referring to claim 23, Goldberg discloses the plasma originating has been synthesized by use of a microwave heating at a broad range of frequencies (col. 4, lines 25-34).

Since Booske et al. and Goldberg are both from the same field of endeavor, a method of ion implantation, the purpose disclosed by Goldberg would have been recognized in the pertinent art of Booske et al. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Booske et al. by plasma originating has been synthesized by use of a microwave heating at a broad range of frequencies as taught by Goldberg to implant boron at low energies (col. 1,lines 23-26).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Pamela E. Perkins whose telephone number is (571) 272-1840. The examiner can normally be reached on Monday thru Friday, 9:00am to 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PEP

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